ELEMENTARY MATHEMATICS

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For several years past, teachers of mathematics and physics both in secondary schools and in colleges have realized, and are coming to realize more and more, a lack in the average student when it comes to putting to practical use what he may have learned of algebra or geometry.

The student has got the idea that algebra is no more than a manipulation of symbols and letters; that, given letters standing in certains relations to each other, one can, if he is so fortunate as to remember the rule, by a certain amount of juggling, obtain a result which looks entirely different from that with which he started and which he is wont to label *answer*.

Many a student, too, thinks that geometry is something entirely separate from algebra, something abstract, which is to be reasoned out in the mind without much reference to the actual. To such students a triangle in the book or on paper has no connection with anything real, as a piece of wood or a town lot. Or, if they have given that the volume of a right circular cylinder ($\pi r^2 h$) equals 36 cubic feet, and the lateral area ($2\pi rh$) equals 24 square feet, if perchance they can find the radius and altitude of the cylinder, they do not realize that they are using principles of algebra.

To overcome this lack, the academy of Northwestern University introduced in 1903 a course variously known as "practical mathematics," "laboratory mathematics," or "mathematics, (a)." The purpose of the course was to cover the same work as before, and to show the student the practical side of algebra and geometry, to teach him to use his common-sense, and to demonstrate to his mind that these subjects have a meaning, and can be used in other courses and in actual life.

The course covers two years, the usual time spent in elementary algebra and plane geometry. In this time is covered the ordinary

work of algebra and plane geometry, and much which is not generally taught in these two courses. As far as possible, the two are taught as one subject, in many instances the one being used as a check on the other; for example, ratio and proportion of algebra, with the actual construction of third and fourth proportionals; or the construction of mean proportionals and square roots checked by the algebraic results for the same thing. Whenever possible, the work of one is used to obtain results in the other. Other topics studied are such as plotting to scale, construction of vernier calipers for measuring diameters of cylinders, experiments to determine the ratio of the circumference of a circle to its diameter, etc. The necessity of formulæ for shortening labor is shown by requiring a number of problems of the same class to be worked, showing that the result comes out in similar form each time. Co-ordinate paper is also used freely in solution of simultaneous equations and various other problems.

The rigid logical proofs are required in the propositions of geometry as well as the check of carefully drawn figures and accurate measurements. All students are required to keep a notebook of all work, and special emphasis is placed on clear, accurate, logical expression of thought in proof and explanation.

One of the great advantages of this course is that the student knows better than by the old methods of teaching how and where to apply his algebra and geometry, or both, to the actual problems of other courses and of life. Then, going from this course directly to physics, chemistry, mechanical drawing, or similar courses, where it is necessary to make the application of algebra and geometry, knowing how, he will make it as a matter of course, until finally it becomes a part of his make-up to do his work in a logical, mathematical, and practical way.

In a very few years the majority of classes in algebra and geometry will be of the nature described above, and the cry of non-practical mathematics will be changed to useful and very practical mathematics.